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# Experience with Syndrome-based Disease Surveillance in Lubbock, Texas: 1999 – Present

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## Introduction

Since early 1999, the City of Lubbock Department of Health has evaluated several "syndrome-based" disease surveillance systems (SBDSS). This brief paper is intended as a preliminary summary of our experience focusing on the utility of SBDSS in accomplishing the following primary goals of public health services[1]:

- Prevent epidemics and the spread of disease
- Protect against environmental hazards
- Prevent injuries
- Promote and encourage healthy behaviors and mental health
- Respond to disasters and assist communities in recovery
- Assure the quality and accessibility of health services

In this summary, we focus on infectious diseases (both communicable and non-communicable) of public health importance.

In theory, SBDSS by virtue of their timeliness and volume of information flows could assist in meeting these central public health responsibilities. In practice however, the specific designs, and underlying technical features and scientific approach and ease-of-use is dramatically different across the dozens of SBDSS currently in existence, some of which have been implemented only in narrowly defined demographic settings or which have other limiting features. The promise is often not met in real-world use.

All SBDSS fall into two basic categories[2]:

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[1] Morbidity and Mortality Weekly Report, February 21, 1997 Vol. 46/7, 150-152

[2] Systematic Review: Surveillance Systems for Early Detection of Bioterrorism-Related Diseases
Dena M. Bravata, MD, MS; Kathryn M. McDonald, MM; Wendy M. Smith, BA; Chara Rydzak, BA; Herbert Szeto, MD, MS, MPH;
David L Buckeridge, MD, MSc; Corinna Haberland, MD; and Douglas K. Owens, MD, MS
*Ann Intern Med.* 2004;140:910-922.

- "Automated" or "passive" surveillance systems that seek to exploit existing data streams and employ various statistical algorithms to detect the presence of infectious disease. Some of the data sources that are "tapped" by these passive systems include:
    - Pharmacy sales (including over-the-counter medications)
    - Total volume of nurse "hot-line" calls
    - Brief "chief complaint" summaries from emergency room logs
    - School and work absenteeism
- "Active" or "clinical" surveillance system that depend on *selected* reporting from physicians, veterinarians, EMS services and other health care providers based on the *clinical judgment* when assessing severity of illness among patients (whether animal or human)

It is also important to note that the overwhelming majority of SBDSS data gathering features focus solely on human patients, despite the fact that in *all* significant outbreaks of novel diseases over the past decade or more in North America, animals were the primary source of the diseases. In particular, the following very large or economically significant disease outbreaks among humans had animal sources:

- Hantavirus Pulmonary Syndrome in the Four Corners Area (1991)
- West Nile Fever (1999, 2000)
- Human plague in New York City in visitors from New Mexico (2001)
- Cryptosporidiosis in Milwaukee (1996) in which 400,000 people were sickened
- Monkeypox in the midwest (2003)
- SARS (2003)
- H5-N1 Avian influenza in humans (1997, 1999, 2005)
- Tularemia transmission from prairie dog-to human in Texas

We would further emphasize that *all* of the CDC's Class A and Class B bioterrorism diseases (with the sole exception of smallpox) are animal diseases (sometimes also called zoonotic diseases). Thus, it is highly likely that if there ever is a large-scale bioterrorism event, animals will almost certainly become ill in large numbers and probably with classical syndromes recognized easily by the veterinary community.

Past Experience with SBDSS in Lubbock

Because public health offices are charged with wide-ranging responsibilities yet are relatively under-funded, the City of Lubbock Health Department began to explore means of leveraging limited resources by utilizing electronic SBDSS in 1999. Although advertised as easy-to-implement and low-cost, we found that all of the "automated" SBDSS systems were problematic in at least four areas:

- The vast majority of cases reported from hospitals and ER-s (based on chief complaints, billing codes or simple census information) resulted in a very large amount of "noise" (data that was of little utility) and which

created a serious liability because of the possible to need to respond to "spikes" that were merely manifestations of statistical randomness.
- Pharmacy-sales data were inherently delayed or complicated by items being "on sale" at large pharmacy chains
- Information is almost always reported in tabular or textual format without mapping (geographic information system) tools for analysis
- In all cases, since the historical background was largely unknown for any of the data streams, comparisons to identify "true positive" deviations from normal was impossible.

At the same time as we were reviewing the automated disease-surveillance systems that were proliferating across the US, we identified one "clinician-based" or "active" SBDSS called the "Rapid Syndrome Validation Program" (RSVP™) developed by Alan Zelicoff, MD (then at Sandia National Laboratories). RSVP[3] defined six common syndromes worded in the daily parlance of medicine and public health, and further provided an electronic interface that operated on virtually any computer connected to the Internet. It also provided primitive, but useful geographic mapping tools. Key to the RSVP design philosophy was the central notion of "clinical judgment" in which participating physicians (some 10% of all of the practicing physicians in Lubbock) were asked to report those individuals seen in emergency rooms, clinics and private offices where the patient was assessed as seriously ill (an assessment that clinicians make routinely) and who fit into one of six syndromes strongly suggestive of infectious disease of public health importance:

- Fever with influenza-like illness
- Fever with skin rash
- Fever with mental status change or neurological change
- Severe diarrhea
- Hepatitis (presumed to be non-alcohol and non-drug related)
- Adult Respiratory Distress Syndrome

Only 15 – 30 *seconds* of physician time is required for reporting a case, and all new reports are immediately reflected on maps of the local public health jurisdiction along with the ability to analyze data using GIS tools. RSVP also allowed Lubbock public health officials to send out alerts on the "front page" of RSVP instantaneously to physicians.

Our experience with RSVP was uniformly positive. Physician compliance was *high* (contrary to the popular, but incorrect belief that physicians will not take time to enter cases) because the number of cases of seriously ill patients who fit into one of the syndrome categories was, on average, a case per month per physician (except during large epidemics). Further, RSVP provided information of immediate clinical importance to physicians thus increasing their cost-effectiveness in practice. Finally, on rare occasions, RSVP enabled public health

[3] Zelicoff A, Brillman J, Forslund DW, George JE, Zink S, Koenig S, et al. The Rapid Syndrome Validation Project (RSVP). Albuquerque, NM: Sandia National Laboratories; 2001.

officials to contact doctors within minutes of a case report when the data suggested unusually worrisome symptoms that might require immediate contact investigation. Thus, RSVP cut down the time from initiation of contact investigation from days to mere minutes.

Our criticisms of RSVP were as follows:

- Because it was a 'web-browser' based system, some particularly operating systems or web-browsers would not fully accommodate the RSVP code and some of its features were inaccessible for certain users.
- Mapping functionality, while useful, was slow and cumbersome
- There was no ability to report key veterinary syndromes (see above) that would often presage human disease
- Statistical analysis via RSVP was somewhat difficult because of the nature of the database where all information was stored
- It was unclear to us that RSVP was NEDSS[4] compliant.

Despite these criticisms, we had two *very* important public health successes with RSVP. We were able to manage the threat of a plague bioterrorism event in January of 2002 when it appeared that strains of the organism were stolen from the Texas Tech University Health Sciences Center by monitoring respiratory disease cases on literally a minute-by-minute basis and providing diagnostic information via RSVP to clinicians. Panic was completely avoided and there was *no* unnecessary diagnostic testing wasting public health resources. We predicted via RSVP that we were dealing with a false alarm and that there were no public health concerns – exactly as turned out to be the case.

Our second success was in early 2003 when we discovered, based on clinical symptoms, the need for earlier-than-usual testing for influenza. This resulted in finding influenza cases in our community approximately three weeks earlier than would otherwise have been possible, probably mitigating much morbidity in the population.

Current Experience

RSVP™ was a useful and highly successful "alpha" product, and the Lubbock City Health Department completed its beta testing of this product. We are currently employing a SBDSS from ARES Corporation in Albuquerque called SYRIS™ -- The Syndrome Reporting Information System. In distinction to RSVP and all of the passive SBDSS in the marketplace, SYRIS addresses all of our critiques of past systems and offers the following:

[4] The National Electronic Disease Surveillance System (NEDSS) project is a public health initiative to provide a standards-based, integrated approach to disease surveillance and to connect public health surveillance to the burgeoning clinical information systems infrastructure. Note that NEDSS is *not* a reporting system per se but rather an architecture description promulgated by the Centers for Disease Control. See MMWR, March 28, 2001

- It is completely platform-independent and does not require a web-browser. Thus, it will run on virtually any Internet-connected device including many handheld devices.
- SYRIS is comprehensive inclusion of *all* critical "health care providers"
    - Physicians, physician-assistants, nurse practitioners and nurse clinicians
    - School nurses (who report absenteeism and commentary)
    - EMS professionals (reporting transport-cases by syndrome)
    - Veterinarians (who have 9 separate syndromes covering all major domestic, agricultural and exotic animal species)
    - Coroner/Office of the Medical Investigator (who also have a list of syndromes based solely on information from unexpected death reports)
    - Laboratory technicians (who can report all lab tests for infectious agents in less than 1 minute per week)
    - Animal control and environmental health officials (who report on captured stray animals or wildlife and the number requiring euthanasia due to severe illness)
    - Wild-life rehabilitators
- Enhanced mapping features based on the "open source" Minnesota Mapping Server that provides for near instantaneous map updating and query to any region where SYRIS is in use.
- Full NEDSS compliance
- Extremely rapid data entry: less than 15 seconds for physicians and veterinarians
- Automated and manual alarm features so that public health officials can be notified by digital paging and e-mail when cases that meet specifically defined criteria (at the discretion of local public health officials) are met.
- Easy statistical analysis of all current and historical SYRIS data
- Easy training: SYRIS is intuitive to use and a full manual is available on-line tailored to each of the 8 user communities defined above
- Low cost: approximately 7 – 8 cents per capita. So, in our catchment area of 250,000 people, SYRIS will cost less than $18,000. This licensing fee includes 24/7 support, all database maintenance and storage and automatic updates to the software each time a user starts SYRIS

We believe that SYRIS will solve the vast majority of our disease surveillance and response needs (including emergency response in the case of bioterrorism) with a *low* false alarm rate and high sensitivity.

Summary

Our experience with properly designed *active, clinician-driven* SBDSS demonstrates that physicians and other busy health professionals *will* report cases of suspected infectious disease if the system is fast (less than 15 – 30 seconds), provides immediate feedback to clinicians on local infectious disease outbreaks, permits selective interaction between public health officials and clinicians on a real-time basis as warranted, and which is inexpensive. SYRIS meets all of these criteria. In addition, unlike the "passive" or "data-mining" approaches, SYRIS has a low false-positive rate (thus mitigating the investigation

of a large number of false alarms and squandering limited public health resources) while at the same time facilitating enhanced relationships between local public health officials and all health care providers.

SYRIS makes public health part of daily human and veterinary medical practice and medicine part of daily public health operations.

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